HYDRAITE

Hydrogen Delivery Risk Assessment and Impurity Tolerance Evaluation

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Programme Review Days 2019

Brussels, 19-20 November 2019

PROJECT OVERIVEW

- Call year: 2017
- Call topic: FCH-04-1-2017 Limiting the impact of contaminants originating from the hydrogen supply chain
- Project dates: 1.1.2018 – 31.12.2020
- % stage of implementation 01/11/2019: 61% of project months elapsed
- Total project budget: 3499867.50 €
- FCH JU max. contribution: 3499867.50 €
- Other financial contribution: -
- Partners: VTT, CEA, Powercell, NPL, ZSW, ZBT, SINTEF AS

PROJECT SUMMARY

HYDRAITE - Hydrogen Delivery Risk Assessment and Impurity Tolerance Evaluation

The objective of the project is to **solve the issue of H_2 quality for transportation applications**:

Lack of representative data for ISO 14687 H2 fuel standard impurity limits

- **Effects of contaminants**, originating from the H_2 supply chain, are studied
  - Methodology for determining the effect of contaminants in automotive PEMFC system

Lack of European laboratory capable to perform full H_2 analysis according to ISO 14687 and EN 17124:2018

- **Three European H_2 laboratories** will be established to offer services to the FCH community
  - Set a network of expert laboratories able to provide qualitative analysis for new compounds with potential negative effect to the FCEV

Lack of public data on fuel composition from HRS (supply-chain derived), both from sampling nozzle and from inline monitoring

- Technical data on **fuel composition from HRS** from sampling campaigns
  - Inline monitoring of H_2 fuel quality

PROJECT PROGRESS/ACTIONS – Impact of contaminants

Achievement to-date

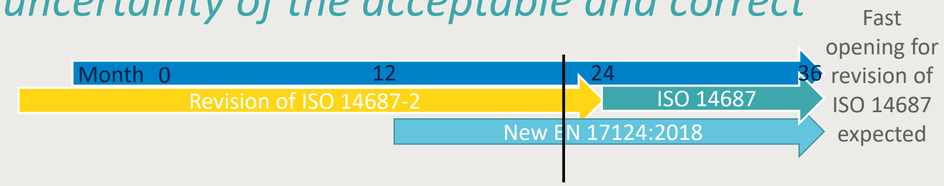
No methodology
Impurity measurements conducted

25% 50% 75%

Methodology developed
3 inter-comparisons between laboratories

Status at month 23 of a 36 months project at date 01/11/2019

- **Six laboratories (VTT, CEA, NPL, ZSW, ZBT and SINTEF) conducting impurity measurements for data for ISO 14687 development**
  - Test protocol for determining the effect of contaminants for automotive PEMFC
    - All partners: test systems with anode gas recirculation, and online gas analysis
    - The use of ^{13}CO for contamination studies (oxidation rate monitoring with $^{13}CO_2$)
  - First-of-a-kind sulphur poisoning measurements with short stack and anode gas recirculation
  - ❖ *Before HYDRAITE – due to lack of representative data, still a large uncertainty of the acceptable and correct limits for number of contaminants*



PROJECT PROGRESS/ACTIONS – European H_2 laboratories

Achievement to-date

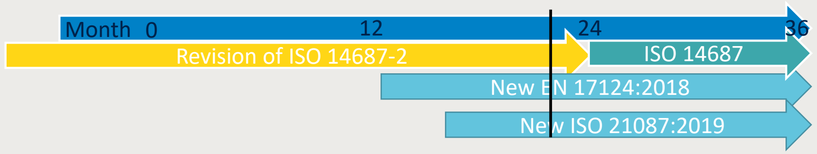
No laboratories deployed
No inter-comparisons

25% 50% 75%

3 laboratories deployed
3 inter-comparisons between laboratories

Status at month 23 of a 36 months project at date 01/11/2019

- **Two laboratories, NPL and ZSW, ready with the analytical methods compliant with ISO 14687-2, (third 12/2019)**
  - Analysis according to ISO 14687, with (partial) compliance to ISO 21087:2019
- **Laboratory intercomparisons**
  - Analysis of 30 HRS samples
    - Project intercomparison (project partners & external laboratory)
    - HYDRAITE intercomparison (involving sampling and analysis)



PROJECT PROGRESS/ACTIONS – H_2 fuel composition on HRS

Achievement to-date

0 HRS samples
No online monitoring at HRS

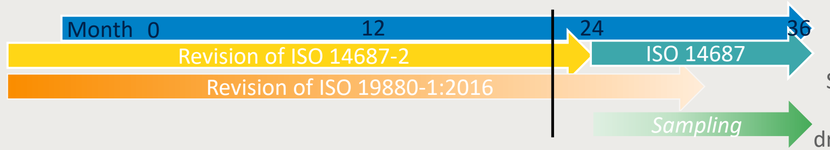
25% 50% 75%

30 samples collected
Data on fuel composition (variation) with online monitoring

Status at month 23 of a 36 months project at date 01/11/2019

- **1st HRS sampling campaign conducted, results reported** (2nd on 3rd year of the project)
  - Newly commissioned stations – H_2 quality generally good

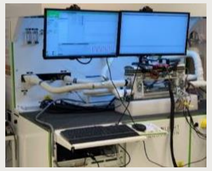
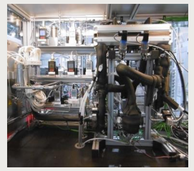
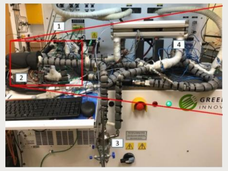
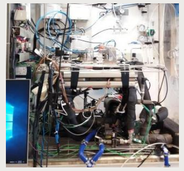
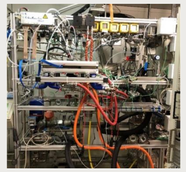
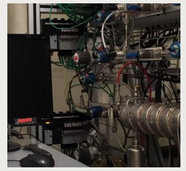
ISO 19880-1



Sampling to be drafted as a standalone standard

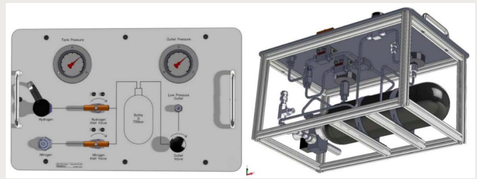
Risks and Challenges

- The implementation of the overall systems have been more demanding task than anticipated
  - ❖ *Mitigation measures – close co-operation between participating partners, efficient exchange of information, good practices and lessons learned*

- Some delay in setting up the H_2 laboratories, due to delays in equipment delivery and commissioning, but also the additional requirements of ISO 21087:2019 (methods for the instrument calibrations, unexpected to be normative)
  - ❖ *Mitigation measures – two laboratories up and running, efficient exchange of information*

- Inline monitoring of H_2 fuel quality at HRS is delayed due to unlucky events at Norway
  - ❖ *Mitigation measures – another station*

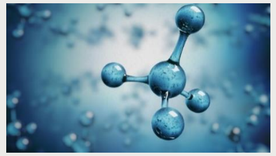


Communications Activities

hydraite.eu

1st HYDRAITE Workshop, at ZSW in Ulm (DE), 7-8 March 2018

2nd HYDRAITE Workshop, at VSL in Delft (NL), 11-12 Sept 2019



2nd HYDRAITE SAB workshop: a joint workshop with MetroHyVe (EMPIR) project
11th – 12th Sept 2019, VSL Delft (NL)

https://hydraite.eu/workshop-on-hydrogen-quality-and-flow-metering-for-hydrogen-fuel-cell-vehicles/

Dissemination Activities

- **2 HYDRAITE SAB workshops** organized
- Invited presentations on
  - HYDROGEN (EURAMET EMPIR) WS (11/2018)
  - INSPIRE (FCH JU) WS (03/2018)
- One **publication** currently work in progress* (others planned)
- Active participation to **ISO TC 197 WG 24** and **WG 27** work (06/2018, 10/2018 and 09/2019)

✓ *WG27 pre-revision meeting held in Delft the 13th of Sept in conjunction with MetroHyVe-HYDRAITE WS*

✓ *HYDRAITE identified as main active European project for supporting next version of the ISO 14687 and of the corresponding EN 17124 (actual start of the work planned in 2020)*

- Most **HYDRAITE deliverables** are **public****

** *Koski, P., Viitakangas, J. and Ihonen J. "Determination of fuel utilisation and recirculated gas composition in dead-ended PEMFC systems" manuscript to be submitted to International Journal of Hydrogen Energy*

** cordis.europa.eu/en, and hydraite.eu/public-reports/

EXPLOITATION PLAN/EXPECTED IMPACT

Exploitation

Exploitable HYDRAITE results are to be identified, i.e. (including, but not only) the European H_2 quality laboratories.

Further detailing of exploitation plan WiP

- EC's Support Services for Exploitation of Research Results (SSERR), and/or
- EC's Common Exploitation booster

→ Consultation services

Impact

- European H_2 laboratories
- Public technical data on H_2 fuel from HRS (sampling and inline)
- *Information on 'new impurities'?*
- Standardization
  - ISO 14687 / EN 17124:2018
  - ISO 21087:2019
  - ISO 19880-1 annex → a separate standard

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